Mr. Michael T. Davis Pre-Calculus	3.6 Solving Exponential Equations Without Logarithms (1) March 1, 2016

Name: Solutions

Solve each exponential equation by converting each base to a power of the same base:

1. $e^{2x} = e^{8}$ $\quad 2x = 8 \quad x = 4$

2. $9^{x} = 3^{5}$ $\quad 3^{2x} = 3^{5} \quad 2x = 5 \quad x = 2.5$

3. $2^{x} = \frac{1}{8}$ $\quad 2^{x} = \frac{1}{2^{3}} \quad 2^{x} = 2^{-3} \quad x = -3$

4. $8^{x-1} = 2^{x+1}$ $\quad (2^{3})^{x-1} = 2^{x+1} \quad 2^{3x-3} = 2^{x+1} \quad 3x-3 = x+1$

$2x - 3 = 1$

$2x = 4$

$x = 2$

5. $8^{x} = 16^{3}$ $\quad 2^{3x} = (2^{4})^{3} \quad 2^{3x} = 2^{12} \quad 3x = 12 \quad x = 4$

6. $\left(\frac{1}{2}\right)^{4-x} = 8$ $\quad (2^{-1})^{4-x} = 2^{3} \quad 2^{-4+x} = 2^{3} \quad -4 + x = 3$

$x = 7$

7. $125^{-x} = 25^{3x}$

$(5^3)^{-x} = (5^2)^{3x}$ $\quad 5^{-3x} = 5^{6x}$ $\quad -3x = 6x$

$0 = 9x$

$0 = x$

8. $216^{3-x} = 36^x$

$(6^3)^{3-x} = 6^{2x}$ $\quad 6^{9-3x} = 6^{2x}$ $\quad 9-3x = 2x$

$9 = 5x$

$\frac{9}{5} = x$

9. $\left(\frac{1}{2}\right)^{-x} = \left(\frac{1}{4}\right)^{x+1}$

$(2^{-1})^{-x} = \left(\frac{1}{2^2}\right)^{x+1}$ $\quad 2^x = (2^{-2})^{x+1}$

$2^x = 2^{-2x-2}$ $\quad x = -2x-2$ $\quad 3x = -2$ $\quad x = -\frac{2}{3}$

10. $8^{\frac{1}{2}x} = 32^{\frac{1}{3}x+\frac{1}{5}}$

$(2^3)^{\frac{1}{2}x} = (2^5)^{\frac{1}{3}x+\frac{1}{5}}$ $\quad 2^{\frac{3}{2}x} = 2^{\frac{5}{3}x+1}$ $\quad \frac{3}{2}x = \frac{5}{3}x+1$

$6\left(\frac{3}{2}x\right) = 6\left(\frac{5}{3}x+1\right)$ $\quad 3\cdot 3x = 2\cdot 5x + 6\cdot 1$ $\quad 9x = 10x+6$

$0 = x+6$ $\quad -6 = x$ $\quad x = -6$

11. $\dfrac{2^{x^2}}{2^x} = 16^{\frac{3}{2}}$

$2^{x^2-x} = (2^4)^{3/2}$ $\quad 2^{x^2-x} = 2^6$ $\quad x^2-x = 6$

$x^2-x-6=0$ $\quad (x-3)(x+2)=0$ $\quad x=3$ or $x=-2$

12. True or False: $27^4 = 3^{12}$

$(3^3)^4 = 3^{12}$ $\quad 3^{12} = 3^{12}$ True

13. True or False: $64^4 = 16^6$

$(4^3)^4 = (4^2)^6$ $\quad 4^{12} = 4^{12}$ True